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$3 PER ANNUM
IN ADVANCE.

Saint Germain or German Study Lamp.

In all the numerous patented improvements in lamps obtained in this country within the last ten years, probably none can compare to this in all the essential elements of a complete and satisfactory lamp for the study, office, reading-room, or wherever a pure, steady, agreeable and perfectly safe light is required. The reservoir is detached from the lamp, so as to avoid casting a shadow; but what is of much greater importance, it prevents the liability to explosion, because the heat of the burner cannot reach the receptacle, and the wick and wick tube is always saturated and full, leaving no space for an explosive gas to form.

The accompanying engravings show clearly the form of the lamp, and its construction will be fully understood by reading the following directions for use:

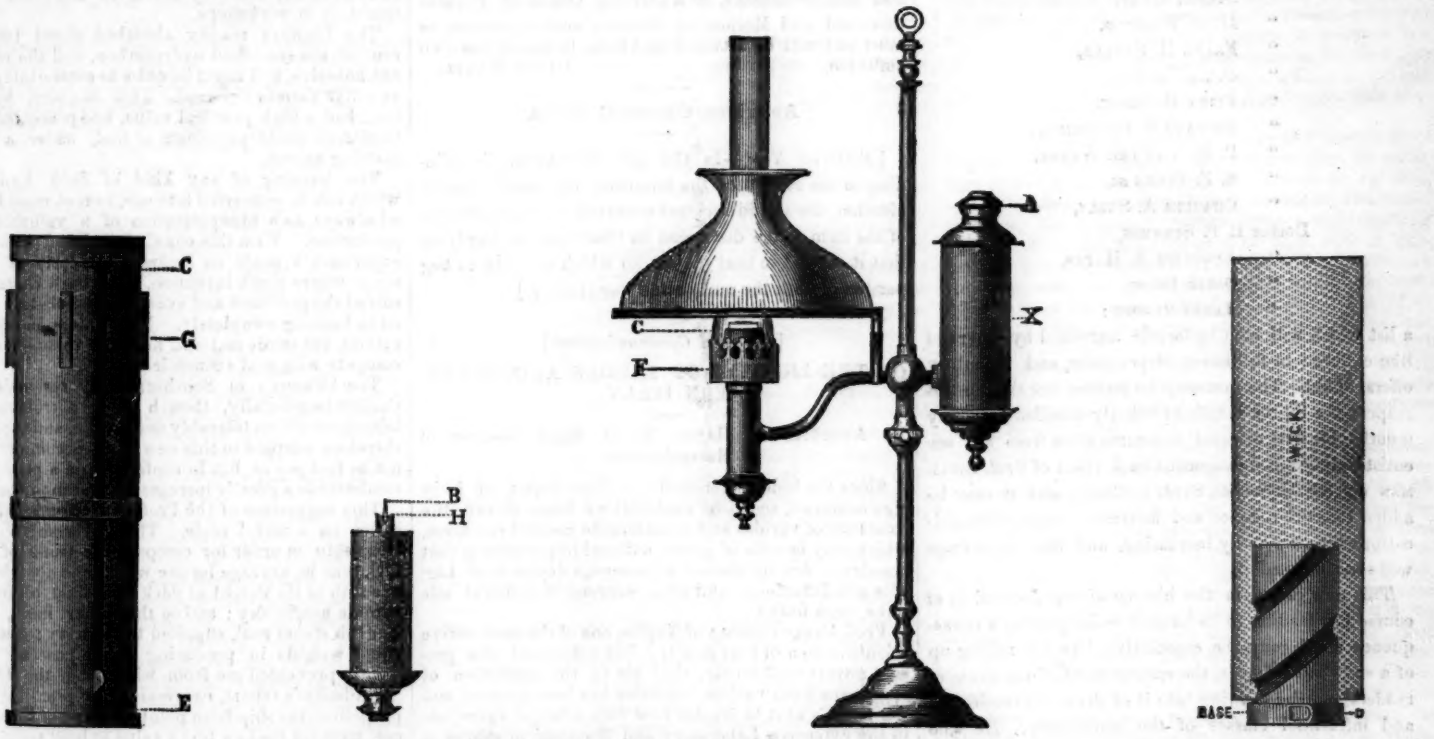
To fill the Lamp, take out the holder, A, invert it and pour in the oil till it reaches the valve; then pull up the valve by means of the wire B, invert it, holding it above the holder X so that any oil which may escape drops into this holder; replace it in the holder X. To put on the wick, take off the chimney holder F, take out the cylinder C, take out the smallest cylinder D, tie the wick at the base of cylinder D, then replace the cylinder D in the large one C, taking care to push it down as far as the point E. Replace everything as before, the large cylinder C having brass catches G up and the ring E down. To raise the wick turn the chimney holder. One-twelfth, or one-eighth of a heavier oil, sperm, lard or olive, mixed with kerosene, makes the best and safest oil.

This lamp gives a very superior and steady light, and with care will emit neither smell nor smoke.

Besides the above pattern, lamps in brass, as well as in German silver, are manufactured with two burners, or double lamps; also, bracket or side lamps, and double hanging lamps or keroseniers, all with the same St. Germain patent burners.

These Lamps have received several Prize Medals etc., at the Industrial Fairs of this country.

C. F. A. Henrichs, 29, 31, and 33 Park Place, N. W. corner of Church Street, up stairs, formerly at 150 Broadway, is sole agent for the United States and the whole of North and South America, of whom further information may be obtained.



SAINT GERMAIN OR GERMAN STUDY LAMP.

Heating Surface of Boilers.

The quantity of steam generally produced on every thirty-nine inches square of surface or cylinder boilers, is from forty-four to sixty-six pounds per hour. In marine boilers it averages about seventy-seven pounds per hour. For high pressure engines the heating surface is generally calculated per horse power, as follows: Small boilers, eighty-five inches; medium size, fifty-five inches; large size, forty inches and even less. For low pressure engines per horse power, as follows: Small boilers, sixty inches; medium sized, forty inches; large size, thirty-nine inches, and even less.

Recent comparative experiments have shown that forty-two feet of boiler surface made twenty-two pounds of steam from 35.2 pounds of coal; 52·5 feet surface made 220 pounds of steam from 30·75 pounds of coal; 63 feet surface made 220 pounds of steam from 29 pounds of coal: 84 feet svrface made 220 pounds of steam from 27·55 pounds of coal; 105 feet surface made 220 pounds of steam from 27·21 pounds of coal —*Deby's Steam Vade Mecum.*

Chemical Repertory.--No. 23.

FEBRUARY 2, 1870.

Editor—HENRY WURTZ.

Editorial.

REQUESTING RECIPROCITY.

Our readers will recall repeated promises that have been held out to them by the Editor, that the men of Science of America would be induced to contribute to these columns, and that this Journal would in time be elevated to the high position of a medium of evolution of original scientific discovery. There were few who regarded without incredulity this ambitious project Reasons, apparently conclusive, which it would be profitless now to reiterate, were rendered against any such attempt. This writer, however, held the belief that it is far from being the Spirit or the Will that is wanting, but only the Means and Facilities; and that in reality no country stands more in need of a Journal, of *frequent* publication, for recording and making known *at once*, the achievements and discoveries of those whose mission it is to wrestle with Nature in the silence of the Laboratory. Our American facilities in this way have been heretofore extremely scant, and complaints thereof have been abundant among those interested.

Abandoning retrospect just now, let us contemplate what has been actually accomplished by persistence. Little more than a year has passed since the writer began devoting to this task such intervals (with serious interruptions) as were left from professional labors, and already he has been favored with original matter, much of it invaluable, from the following Galaxy of American Scientists:

Professor B. SILLIMAN,
" STERRY HUNT,
" H. F. WALLING,
" FRANK H. STORER,
" C. A. YOUNG,
" PLINY E. CHASE,
" EDWARD C. PICKERING,
" P. H. VAN DER WEYDE,
" S. F. PECKHAM,
" CHARLES A. SEELY,
Doctor R. P. STEVENS,
" AUGUSTUS A. HAYES,
" OSCAR LOEW,
" JAMES BUSHEE;

a list which will soon be largely increased by others of like calibre; in fulfilment of promises, and voluntary offers, of aid. The fact may be pointed out that in this respect the Editor remained wholly unaided for many months, his first original communication from any scientist dating but five months back (that of Prof. SILLIMAN on *Wollongongite*, Sept. 2, 1869); and it may be added that the number and interest of such communications is now rapidly increasing, and that *more room* will soon be needed.

This new phase in the history of our Journal is of course fast leading to its natural consequence, a consequence which must be cumulative, like the rolling up of a snowball; that is, the enlargement of our circle of readers and the drawing into it of the more intelligent and influential classes of the community. He who adopts "Excelsior!" as his motto, must continually enlarge his field, not only of vision, but of visibility.

The experiment of the Editor must then be regarded as already a remarkable success, and the perpetuation of the project may now be readily secured, by the further kind aid of the patrons of the Journal. *Reciprocity* is all he petitions for; and benefits conferred by the patrons of the Journal cannot but be reflected upon themselves in many ways. The labors of the present writer have hitherto been *gratuitous*, and hence, unavoidably, fitful, desultory, and far from satisfactory to himself. The results have shown, nevertheless, what may be accomplished by greater, more uniform, and more systematic work. Such, the undersigned is about to begin, and he calls for aid in so doing. *Lack of space* in our columns is an obstacle to increase of their usefulness. He trusts and intends, by occupying shortly with reading matter, double or treble the present space, to augment manifold the interest and value of the Journal to its supporters. This, however, involves manifold more labor, much beyond any reasonable, or even possible *gratuitous* point.

There is, under the circumstances, but one way of reconciling these objects. This way, in spite of some of some finical opposition of friends, and doubtless much cynical opposition elsewhere, the undersigned has determined to adopt. Each two columns of reading matter under this head will shortly have appended at least one column of *advertising* space, which may be occupied by such advertisers as desire to communicate, in a business way, with that most important and influential section of the intelligent public which now constitutes our rapidly increasing circle of readers and contributors.

In our next issue we propose, if found practicable, to initiate this new system; and those who wish to avail themselves of it are desired to communicate at once to the undersigned. It is an opportunity which hardly offers elsewhere to this class of advertisers. These REPERTORY *Advertising Columns* will be most select, and closed (as it is not necessary to add) to all quackery and pretense. At first, of course, the space will be limited, but in proportion as these advertisements accumulate, space for reading matter will be added (by increasing the volume of the Journal itself). Thus there will be included new departments of reading matter, of the utmost import and value. It may even become practicable to convert our Journal into a weekly.

The undersigned reiterates therefore his plea. Reciprocity is what he asks of his friends. The realization of the above plan will quickly and surely lead to the rapid elevation of this Journal to a position high and unapproachable, as a Sterling Organ of Popular Chemical and Mechanical Science, such a position as must and will be attained and held, to satisfy his own ambition.

HENRY WURTZ.

American Chemical News.

[*Editorial Note.*—In the last REPERTORY, in alluding to the receipt of the following esteemed communication, the stupid accident occurred of an attachment of the item to the discussion on Coal-Genesis, implying that it related to that subject, for which we have to beg pardon of both the author and our readers.]

[*Original Communication.*]

ON THE LIGNITES OF MIDDLE AND SOUTHERN ITALY.

By AUGUSTUS A. HAYES. M. D. State Assayer of Massachusetts.

Since the independence of the Free States of Italy was achieved, scientific explorations have shown the existence of various and considerable natural resources, which may become of great national importance to that country. Among these are numerous deposits of Lignite and Bitumens; and even sources of mineral oils have been found.

Prof. CARLO CASSOLA of Naples, one of the most active scientific men of that country, has influenced the present government so far, that aid in the collection of specimens from various localities has been secured, and the parcels sent to Naples now form a large aggregate in the extensive Laboratory and Museum in charge of Prof. CASSOLA.

Through the kindness of the Professor I was allowed to examine and analyse some of these samples, and I also visited one of the deposits, a few miles distant from Benevento, in company with himself, scientific friends, and representatives of the government.

The Lignites are found in a formation which represents the Tertiary of this country. Clay, conglomerate, and decompo-ing schists were the immediate inclosing rocks of this locality, and the beds had evidently been broken up and moved from position of deposition, by superficial changes.

Some of the Lignites presented the varieties of brown coal, with more or less of woody structure visible, and they differed in power of retaining moisture, in gravity, color, and compactness. One variety was remarkable, inasmuch as it so closely resembled Cannel Coal in appearance and general physical characters, as to be easily taken for Cannel. It requires indeed careful examination to enable one to distinguish it from Cannel; and, as seen, it promised to prove an excellent fuel.

I engaged in the chemical analysis of the Cannel-like variety with great interest, and soon found it to differ remarkably from ordinary Lignite in containing a large proportion of combined water, which was retained after long exposure to a high temperature. Indeed, some samples afforded water at 600° F., and the point of compete desiccation did not vary more than 50° F., from the point of temperature necessary to cause decomposition.

An air-dried selected average sample of the Cannel-like variety afforded

Moisture, as given off at 100° to 110° C.	3.40
Water, lost in air at 200° to 230° C.	18.20
Volatile combustible matter	29.80
Solid carbon as compact coke	43.60
Grayish white ash	5.00
	100.00

The above composition does not express a valuable fuel—and other samples contain not only more combined water, but earthy substances also, which would appear as ash in large amount. Indeed, the varieties of these minerals found in Southern Italy, when compared with good laminated coal as fuel, or as a source of power, did not warrant the belief that they can replace coal.

This is a subject of vital importance to a nation wishing to maintain steamships upon the ocean, or to carry on those operations in which fuel is an essential element of aid, and every well-wisher of Italy will be interested in the effort now put forth in the search of coal, and in devising substitutes for this mineral suitable for consumption on ship-board. There is much of newly awakened enterprise and activity of mental ability in free Italy, and the sources of physical well-being and progress were never more carefully scanned in all directions.

In connection with the subject of fuel, it was a happy suggestion of Prof. CASSOLA, that led to the mode in which these Lignites and hydrous fuels may be burned with advantage. He proposed to mix or saturate the porous lignites with the crude natural bitumens, and burn the nearly dry artificial mixture thus made as coal, in any ordinary stove, or fire place on ship-board, or in workshops.

The Lignites readily absorbed about twenty per cent of the semi-fluid hydrocarbon, and the result was not adhesive, and could be quite as comfortably handled as softer varieties of coal. This mixture, by estimation, had a high practical value, and presented the utilization of crude petroleum as fuel, under a new and inviting aspect.

The burning of any kind of fluid hydrocarbon, which can be converted into oils, as fuel, must be regarded always as a misapplication of a valuable natural production. With this conviction, I had witnessed the experiments made on board a gun-boat of our own navy, where much invention, of a high character, had solved the problems and overcome the obstacles presented in burning completely. Yet, unless in other applications, the crude material has little value—it can never compete with coal economically.

The bitumens of Southern Italy resemble those of California generally, though their petroleum oil has been drawn from tolerably deep wells, and the latter are therefore adapted to this new use; becoming valuable, not as fuel *per se*, but in conferring on a poor hydrous combustible, a greatly increased power in producing heat.

This suggestion of the Professor at once led to application on a useful scale. The government placed a steamship in order for comparative trials of the new fuel, that is, average lignite which had absorbed about one-fifth of its weight of dark semi-fluid bitumen, and become nearly dry; and on the other hand, the best English steam coal, supplied to the navy; were used in equal weights in producing steam-power. Engagements prevented me from witnessing the trials, but the Admiral's report, expressing the practical results of propelling the ship from point to point of equal distances, gave for the new fuel a value at least equal to that of the best coal, for naval purposes. The mixed fuel in the trials was burned in the ordinary coal furnaces, and did not produce smoke.

This application of Prof. CASSOLA becomes of great importance therefore, if subsequent search shall show that Italy possesses large deposits of lignite and bitumens, and this mode of utilizing hydrous lignites, carries with it those practical features which recommend its adoption, wherever hydrous fuels and bitumens can meet as products of small value on the spot.

In California, where semi-fluid bitumens exist, the increasing facilities for transportation may allow the value of lignites of that and other States to be greatly increased, by the absorption of bitumen; so as to form an artificial fuel, in which the combined water of the lignite will be utilized to form a strongly heating flame, in the otherwise smoke-producing vapors of the bitumen.—BOSTON, MASS., December 29th 1869.

[*Original Communication.*]

LETTER FROM PROF. STERRY HUNT.

MONTREAL, Jan. 10, 1870.

My Dear Prof. WURTZ: I have read with much interest your "Studies in Chemical Geogony," presented to the Salem Meeting of the AMERICAN ASSOCIATION in August last, and since published in your CHEMICAL REPERTORY of November 16, and January 3. With most of the propositions there advanced I agree, as I have indeed maintained them myself for many years. Thus, the view that the sea of the primeval time held all the chlorine which is now contained in its water, has been taught by me since 1858; when I endeavored to show that the atmosphere surrounding the cooling globe held in the form of carbonic, sulphuric (or sulphurous) and hydrochloric acids, all the carbon, sulphur, and chlorine of the globe. From the action of these acids on the yet heated crust of the earth, I explained the origin of soluble chlorides and sulphates whose solution formed the primeval sea, while the action of carbonic acid on alkaliferous and calcareous silicates subsequently removed carbonic acid from the air, and fixed it in the form of carbonates of lime, etc. The action of vegetable life in further removing a portion of carbonic acid and liberating its combined oxygen, and the geological importance of the organic matter thus produced was also insisted upon. (*Amer. Jour. Science*, 1858, xxv, 103–436.) From these data logically flows the whole system of chemical geology which I have ever since taught. I have maintained that *the condition of the cooling globe was one of thorough oxidation, and that all processes of reduction or deoxidation are either directly or indirectly dependent on organic life, to which I ascribed the formation of metallic sulphides and beds of iron ore* in rocks then looked upon as Azoic.—*Ibid*, 1860, xxx, 134, and 1861, xxxi, 396.

I have further taught that the first precipitates by the action of carbonates from the primeval sea, would contain most of the metals, and that the resolution of these oxidized precipitates and their reduction by the agency of organic matter to the form of sulphides, or to the metallic state, furnish the basis of a rational theory of metalliferous deposits. (*Am. Jour. Science*, 1861, xxxi, 405; 1865, xl, 212.

As to the question raised by you, whether any free oxygen existed in the primeval atmosphere, I have elsewhere suggested that there was a probable excess of this element over that required to satisfy the affinities of hydrogen and carbon. This, one would infer, from analogy with the conditions now considered requisite for the development of life. The inquiry, however seems to be of secondary importance, since you agree with me that vegetation is the sole agent of reduction, directly liberating oxygen from carbonic acid, and by the carbon thus reduced, deoxidizing sulphates and metallic oxides, whose oxygen is in the form of carbonic acid restored to the air, to be liberated in its turn by the agency of vegetation.

As regards the final Zoic Catastrophe, to be brought about by the total elimination of carbonic acid from the atmosphere, its fixation in the form of carbonate of lime, and the consequent extinction of vegetable life, I may suggest that chemical changes going on in the depths of the earth are constantly liberating carbonic acid from its combinations, as shown not only in volcanic regions, but in many other districts. May not this replace the amount removed from the atmosphere in the state of carbonate of lime, and thus maintain the equilibrium necessary for the preservation of the present order of life on the earth?

As regards the composition of the primeval sea, I have always maintained the opinion that its water contained in the form of chloride of calcium all of the lime which the carbonate of soda from the decay of feldspathic rocks has in the course of ages precipitated therefrom. In my contributions to the Chemistry of Natural Waters (*Am. Jour. Science*, March, July, and September, 1865) in Sections 24 and 25, this question is touched upon, and the source of many saline springs in the fossil sea-water of paleozoic times is maintained As regards the saline water from the Bay of Quinté, whose analysis by me you cite, with Dr. GOESSMANN'S comment thereon, that it is probably a bittern resulting from the evaporation of ancient sea-water; an attentive perusal of the section (37) in the paper just referred to, would show that I had long before expressed precisely the same opinion, namely, that this and a number of similar waters described in connection with it, were not ancient sea-water but ancient bitterns, as was obvious both from their high specific gravity and the absence of sulphates. Faithfully yours,

T. STERRY HUNT.

REJOINDER TO PROF. STERRY HUNT.

By HENRY WURTZ.

I must be allowed to maintain that my excellent and esteemed friend has been too hasty in thinking that I have been going altogether over the same ground that he himself has previously traversed. I must call attention, in illustration of this, to some divergences in our respective views, leading to conclusions which differ in many respects widely and radically. First, however, I would say that I have been most happy to adopt, as theoretical postulates, some of his own profound and brilliant generalizations, and that I have, in previous writings, given him, as I give him now, entire credit; for example, for his induction, inevitable to the *chemical* student of Nature, as to the essential influence of Life, in the generation of sulphides, ferrous silicates, graphites, and other products of *deoxidation* in past ages. I will here quote again, as I have once before, his first and original statement of this grand induction, which will be found in the *American Journal of Science* for May, 1861:

"The great processes of deoxidation in nature are dependent upon organization; plants by solar force convert water and carbonic acid into hydrocarbonaceous substances, whence bitumens, coal, anthracite, and plumbago; and it is the action of organic matter which reduces sulphates, giving rise to metallic sulphurets and to sulphur."

This discovery of our illustrious American chemist has in fact been adopted among the classic utterances of Science. MOHR, in his "*Geschichte der Erde*" (1866) sets down the following as established:

"Sulfur et sulfuris combinationes in terra ad gypsum marinum referuntur; pyritæ, generaliter dicta sulfureta metallica, ex oxydo metallico, sale sulfurico, corporum organicorum labore, et aquæ adminiculo, originem ducunt."

[Literally in English: "Sulphur and combinations of sulphur in the earth, are referred to marine gypsum; pyrites, generally called metallic sulphurets, derive origin from sulphuric salts of metallic oxides, by the agency of organic bodies, and with the aid of water."]

Prof. HUNT, in a private letter sent with his paper, expresses a fear "lest bye and bye his portion in these grand conclusions should be overlookod, as has already happened to him in the case of his theory of chemical types." He may assure himself that he will suffer no such injustice, if the pen that writes these words can prevent it. The discovery referred to above, universally conceded, so far as I know, to him, is immortality in itself.

Still, whilst I admit that I have followed in his steps thus far, I must claim to have pushed on further in the path, inasmuch as I see these things from new points of view. Above all, I am impelled to claim that my own point of *departure* has been entirely different from that of Prof. HUNT, at least in his more recent writings. For example, in his now celebrated lecture "On the Chemistry of the Primeval Earth," before the Royal Institution in London, May 31st, 1867; his reasoning seems to me to be chiefly of the *a priori* species: whereas I have endeavored always to get at these questions by the *more laborious but direct* path called *a posteriori*. I claim therefore that the induction I have set forth ought certainly to possess in greater degree the elements of *safety*, however they may startle our previous conceptions.

I find myself impelled indeed to interpolate here the suggestion that the prime cause of such divergences in the conclusions of different minds, in endeavoring to follow the same track, should have some special solution. LAPLACE'S fascinating "Nebular Hypothesis" is doubtless the "*Deus ex Machina*" here. I would submit that *any hypothesis* must need be a blind guide; and that our search after the unknown should always have the KNOWN as the *point d'appui*.

This premising, I proceed to specify a few of the points wherein I am unable to concur with my eminent correspondent. Time and space, which now fail me, will be occupied hereafter in enlargement and elucidation of these and other propositions. With Prof. HUNT, then, I differ among other things;

1st. In his assumption that there is more than enough Oxygen for all the Carbon and Iron in the Crust of the Earth; and that, therefore, Oxygen has always existed as a free element. (From the above note, it would appear that he does not *now* insist very strongly on this.)

2d. In his assumption of mysterious and inexplicable modes of liberation of carbonic acid from unknown materials in the telluric viscera; which liberation is assumed to be competent to compensate the mode of ceaseless exhaustion which I have for the first time pointed out. Even if his hypothesis could be admitted, and it could be shown that rocks not themselves sedimentary, or rather rocks antedating Life, now evolve carbonic acid, which seems incredible, it is still necessary that we admit an *indefinite* continuation of such hypothetical evolution, to establish the idea of the perpetuity of Life upon the Earth.

3rd. In his assumption that the *lime* of Oceanic Sediments of past Eons came from the Prozoic ocean; instead of from the silicates of the continental nuclei. This seems to me in fact altogether irreconcilable with some of his own past *inductive* conclusions; though it may be that if we start from *the other end;* that is, from the Nebular Hypothesis; such a view might be arrived at.

Careful readers of my papers, in these and other columns, will discern other differences.—H. W.

DR. B. A. GOULD "ON THE CONSTITUTION OF THE SUN.'

[The recent popular lecture of our eminent American astronomer, constitutes a digest so admirable and perspicuous, of a subject now taking such hold of the scientific public, that our readers will no doubt be pleased to find that we give place, even to the exclusion (for the present) of other matter, to at least those portions which relate to heat and light. Dr. GOULD'S lecture, it appears to us, affords a model of such popular expositions of scientific discovery as the American public (at least in our own great city, to its disgrace) are not often treated to.—H. W.]

THE SUNS HEAT.

The sources of the light and heat of the sun—the only two of his marvelous properties apparent to the ordinary observer—are problems of the greatest difficulty. I will only say here that the most vivid light developed by human art, when interposed between the eye and the sun, appears like a black spot upon the solar disk. The highest temperature yet produced by man is that evolved by the combustion of charcoal in oxygen, which BUNSEN estimates at 10,000 C., or or 18,000° F.: and this is about five-sevenths of the lowest reasonable estimate for the temperature of the solar surface. Coal burning at the rate of 1 lb to the square foot in about 2 seconds would attain this temperature, and Rankine has estimated that in the furnaces of powerful locomotive engines, a pound of coal to each square foot of grate surface is consumed in from 30 to 90 seconds, yielding a heat from 1-15 to 1-45 as intense as that at the surface of the sun.

Adopting this estimate that a heat equal to that emitted by the sun might be attained by the combustion of coal at this rate of one-half pound per second to the square foot, it is easy to find how long the whole mass of the sun would last, were it composed of coal burning at that rate, and furnished moreover with an unlimited supply of oxygen to support the combustion. Performing the calculation, we find that the entire sun would be consumed in a little more than 4,000 years, that is within a period no longer than that over which human history extends.

And now, what is this sun of ours—this center round which eight large planets, with not less than 18 satellites and 109 small planets, are known to revolve, beside comets unnumbered and countless swarms of meteors; this luminary, whose fervent and dazzling beams radiate and have radiated for ages with a profusion which has shown no signs of failing, although the most vehement combustion fails to equal it in heat, and the most intense electrical action falls short of it in light; which, thus pouring out, has decreased neither in weight nor size to any extent which human skill has sufficed to detect? And does the realm of nature show any other object comparable with it in magnitude or in character? These are among the questions which force themselves on our consideration.

The sun is a star, apparently not unlike the most of those which gem the sky by night. This seems a better statement than to say that the stars are suns, although it would be difficult to give a good definition for either word. Our idea of a sun seems to imply that it is a center for a system of planets or satellites, dependent upon it for their light and radiant heat. There is some ground for believing this to be the case with some of the fixed stars, but for supposing it to be so with most of them there is no reason other than the supposed analogy. But that the sun is a star, one of the same great company which spangle the firmament, and indeed one of the countless myriads which compose the single nebula which we see all around us like a ring and call the milky way, seems a well-established fact. Here, as with them, that same law of gravitation holds unrestricted sway which the double stars reveal to us as the guide and controller of their motions. Like many of them it is variable in its light, although only to a small extent and with a long period. Like them it is journeying through space drawn by some powerful attraction, in a stupendous orbit around some center which astronomers have not yet succeeded in recognizing. Its annual motion has been computed by OTTO STRUVE to be 150,000,000 miles.

And notwithstanding its awful magnitude, we must still regard the sun as a comparatively small star, at least as not above the average size. This is proved by comparing his light with that of the very few fixed stars whose distance can be computed, and therefore be compared with that of the sun.

When we view the sun through a telescope of moder-

ate power, provided with a deep shade glass, or with a solar eye-piece, we see a bright disk, in which no measurement has yet detected any variation from a perfect circle. This circle is not of equal brightness, the central portion being much more brilliant than the parts near the circumference. Nor is the solar brightness equable in other respects, but the whole surface appears mottled by small variations in brilliancy, which have been compared to the irregularities upon the rind of an orange, and to the uneven surface of a stormy sea.

SPOTS ON THE SUN.

Usually, too, several spots, or groups of spots, of irregular and often of fantastic shape, are to be seen variously distributed, but almost always within a belt crossing the sun centrally, and not so wide as one-half his diameter. These spots differ in size from the smallest visible one to a breadth of 1', which is 1-16 of the diameter of the sun, and corresponds to seven times that of the earth; and a short period of examination suffices to show that their forms and dimensions are undergoing continual and rapid changes. Ordinarily, and, indeed, always if of any considerable magnitude, they consist of two distinct parts, each sharply defined, viz: a dark inner portion called the umbra or nucleus, and an extensive grayish border, much brighter than the nucleus, and called the penumbra. Sometimes, though not often, the sun is seen entirely free from spots, while at other times they are extremely numerous, more than 50 having been seen at one time. Not unfrequently they are visible to the naked eye through a smoked glass.

Finally, yet another appearance presents itself to the observer with a telescope of moderate power, viz: patches or streaks of light more brilliant than the rest, and not to be confounded with the general mottling of the surface. These are called faculæ, and are generally, but not always, of an elongated form, and chiefly manifest in regions near the limb or margin of the sun, where the fainter light, and some other causes, render them especially conspicuous. Faculæ may almost always be seen in the close vicinity of the spots, and generally to the left of them: but they are not restricted to these situations, and may be found in regions where spots are never seen.

WILSON'S THEORY.

To explain the phenomena of the spots, DOMENIC CASSINI suggested, in 1671, that the sun's surface must be an ocean of light, surrounding the dark and solid central body of the sun, and whose tumultuous agitation sometimes discloses some mountain summit which appears as the black nucleus of the spot. This suggestive idea formed, however, only a first step toward the solution of the problem, the honor of which belongs to a Scotch astronomer, Prof. ALEXANDER WILSON of Glasgow, 100 years later. WILSON observed that the penumbra or grayish border which surrounds the dark nucleus, and which is generally of about equal width on all sides when the spot is near the middle of the sun's disc, always became narrower on the side nearest the middle of the sun, when the spot approached the circumference. Hence he inferred in 1773 that the spots were funnel-shaped apertures in the luminous envelope, which disclosed the dark body of the sun at the bottom, and whose shelving sides constituted the penumbra. A moment's inspection of the diagram will show how such an aperture would at the middle of the disc exhibit the full size of the nucleus, D E, and an equable border, represented by the apparent breadth at C D and E F of the inclined sides of the opening; but that when it is nearer the circumference, as at A B or G H, the nearest side becomes foreshortened, as does also the nucleus, though to a less extent, while the furthest side of the aperture is presented much more fully to the view.

If, therefore, the appearances be as stated by WILSON, the inference seems irresistible that the spots are openings in the glowing envelope of the sun. To make sure of the facts in the case, the Directors of the Kew Observatory have carried out an extensive examination of all the drawings and photographs of solar spots, which they could make available, and the enormous preponderance of observations in favor of this theory must be considered as definitely settling the question. Mr. DE LA RUE also suggested the use of the stereoscope to decide whether the spots are actually cavities or depressions, with the same result. But this argument, although a strong one, can hardly be deemed conclusive, for our senses are tricky guides, and things are not always what they seem.

But why should the sloping sides of such a cavity manifest that diminution of the solar luster which the penumbra exhibited? Because the darker body of the sun would be partially seen through it, would be our first reply; but a moment's thought will show that were this the true explanation, the penumbra would exhibit different degrees of luminosity, and shade gradually away from full brightness at its circumference to darkness at its inner margin. That is not the appearance; but the boundaries of the penumbra are sharply defined and its color is tolerably uniform throughout. To meet this difficulty the German astronomer BODE, assumed a second envelope of a cloudy nature, supported by an atmosphere, and situated between the true body of the sun and the photosphere, as the outer light-giving envelope is called. The reflection of the photosphere from this surface would account for all the light of the penumbra, while the nucleus of the spot would be the body of the sun as seen through the opening in this second envelope. Twenty years later, the great WILLIAM HERSCHEL added the idea that the transparent, elastic atmosphere in which the stratum of clouds must be suspended at a height of not less than 4,000 miles, likewise supported, and extended beyond, the photosphere. Emanating from the true surface of the sun, this gaseous atmosphere streamed upward, displacing the material of the surrounding cloudy stratum and of the thinner photosphere. It is a curious fact that a hypothesis almost identical with this theory of HERSCHEL had been propounded as early as the middle of the fifteenth century, before the existence of the spots was known to astronomers; yet this must be regarded rather as a fortunate guess than as a scientific theory, for the evidence by which alone such a view can be supported was not then known.

The general aspect of solar spots will be seen by the representations in the diagrams. The enormous magnitude of some spots has been already mentioned—huge chasms which cover an area of some two billions of square miles, and whose mouths would receive at once forty or fifty globes as large as our earth. Their continual and rapid changes of form and size, make it peculiarly difficult to settle many interesting questions concerning them, but decided indications of rotary motion have been observed in many of them, which would imply that they are turning like huge whirlpools around their own centres. The nucleus, although we speak of it as black, and although it appears intensely so in contrast with the glowing radiance of the surrounding portions, is in itself by no means devoid of brightness. It has been well said by WINNECKE, that were the light of the whole sun to be extinguished, excepting the portion radiating from the nucleus of a spot, our eyes would scarcely be able to endure the dazzling beams. HERSCHEL'S estimate has generally been considered too low, yet it would give the dark nucleus of a spot a luminous intensity, nearly 2,500 times greater than that of the full moon.

A curious and frequent appearance is that of so-called bridges, which often cross a spot, dividing it like partitions. Sometimes these are intensely brilliant, crossing penumbra as well as nucleus, while in other cases they are no brighter than the penumbra, and only perceptible when in contrast with the dark nucleus. Both their formation and disappearance have been frequently observed; tongues of light are seen darting across from one side, or from both sides toward each other, until the bridge is established, and in a way not unlike that which naturalists describe when microscopic organic forms are in process of development; and again they are seen to fade gradually away, growing fainter and fainter, until from an intense brightness they have seemed to dissolve and disappear. These also are depicted in the diagrams.

[To be continued.]

The Monthly Coal Sale.

THE SPECULATORS DOWN IN THE MOUTH.

The regular monthly sale of Scranton coal took place on Thursday, 27th ult., at the Delaware, Lackawanna and Western Railroad Company's salesrooms, No. 26 Exchange place, J. H. Draper, & Co., auctioneers. Seventy-five thousand tons were offered, and sold at prices considerably lower than last month. Several attempts were made to bid up the price, particularly on the stove coal, but the tendency of the market was downward, and the scheme did not succeed.

The following bids will show the market as it now stands:—

	Tons.	Price.
Lump	7,000	$4 00 a $4 17½
Steamboat	12,000	4 20 a 4 45
Grate	12,000	4 30 a 4 42½
Egg	10,000	4 15 a 4 40
Stove	24,000	4 82½ a 5 00
Chestnut	10,000	3 87½ a 4 00

The first bid offered on stove coal was $4 50, but none was sold at that price, a higher price being bid immediately. Notwithstanding the effort to keep up the price, all the various grades sold lower, the average prices of last month's sale being as follows:—

Lump	$4 32½	Egg	$5 32
Steamboat	4 45	Stove	6 01½
Grate	5 08	Chestnut	4 21½

This shows an average decline of 24c. on lump 12½c. on steamboat, 71½c. on grate, $1 04½ on egg, $1 10½ on stove and 28½c. on chestnut.

Gas Bill—In Assembly, Jan. 19.

AN ACT TO AUTHORIZE THE CONSTRUCTION OF GAS WORKS AND THE MANUFACTURE AND SALE OF GAS, FOR THE PURPOSE OF LIGHTING A PORTION OF THE CITY OF NEW YORK AND THE STREETS, AVENUES, SQUARES AND BUILDINGS THEREIN, AND TO LAY PIPES FOR THAT PURPOSE.

Introduced by Mr. FIELDS—read twice, and referred to the Committee on the Judiciary—reported favorably from said committee, and committed to the Committee of the Whole.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. Shepherd F. Knapp, William Fowler, Jr., George B. Grinell, Isaac P. Martin, Joseph C. Williams, John T. Agnus, John Whittiker, Jr., P. G. Baxter, Jr., E. Jones, Leroy Knight John McB. Davidson, Thomas Nelligon, Bernerd Reilly, Daniel Butterfield, Thomas Watson, J. Martine Smith, Thomas Y. Avery, Cornelius O'Reily, John E. Cronly, Joseph Holland, and their assigns, are hereby authorized and empowered, at any time hereafter, to manufacture, make and sell gas, to be made of coal, oil, tar, peat, pitch, turpentine or other materials, to be used for the purpose of lighting all that portion of the city of New York, lying north of the centre line of seventy-ninth street, including all of the central park, in its entire width and length, and all streets, avenues, lanes, alleys, squares, and parks, within the limits aforesaid, and any buildings, manufactories or houses, contained and situated within the said limits, and to lay pipes for the purpose of conducting the gas, in any streets, avenues, lanes, alleys, squares and parks, of said portion of said city, and in the said central park, and to adopt any other necessary means to furnish gas to any inhabitant in said portion of said city, and to the said central park, and also the said persons and their assigns, shall so conduct their manufacture or manufactures of gas as not to create a nuisance, and that in digging and laying pipes in any public street, avenue, lane, alley square, park or highway, the same shall be done in a proper and workmanlike manner, with as little delay and inconvenience to the public travel as practicable, and without injury to the croton pipes, and surface of such street, avenue, lane, alley, square or park shall thereupon be immediately restored and repaired by said persons, or their assigns, to the condition in which it was immediately before the laying of such pipes. The rights and priveleges hereby granted are exclusive, but shall not be construed to effect or impair any exclusive rights or privileges, if any, vested in any incorporated company in said city.

SEC. 2. That the said persons, and their assigns, have power to purchase and hold real estate, necessary and convenient for the purposes aforesaid and to erect and maintain all necessary and convenient buildings, fixtures and machinery for the aforesaid purposes, and incident, or necessary thereto.

SEC. 3 If any person or persons wilfully do, or cause to be done, any act or acts whatever, whereby the works of said persons, or of their assigns, or any pipe, conduit, plug, cock, reservoir, or any engine, machine, or structure, or other thing appertaining to the same, shall be stopped, obstructed or impaired, weakened, injured, or destroyed, the person or persons so offending shall forfeit and pay to the said persons or their assigns, treble the amount of the damage sustained by means of such offense, or injury, to be recovered by said persons, or their assigns, with costs of suit, in any court having cognizance thereof.

SEC. 4. This act shall be deemed a public act, and shall be favorably construed for the purposes herein expressed and declared, in all courts and places whatsoever.

SEC. 5. This act shall take effect immediately.

[Since the above was put in type, it has come up for its final passage! It was however, recommitted, and it is now apprehended, we understand, by its friends, that it will fail.—EDS.]

New York Society of Practical Engineering.

The regular monthly meeting of this Society was held at their hall in room 24, Cooper Union Building, on Wednesday evening, January 12; the President, James A. Whitney, in the chair.

The paper of the evening was prepared and read by Mr. J. K. Fisher, on "Steam Road Rollers."

The writer said: We have three steam rollers, two by Aveling & Porter, 15 tons each, and one designed by me of 14 tons. The cost of rolling by Aveling's in the Brooklyn Park is reported by Mr. Martin, engineer of the Park, as a quarter of the cost of the seven ton horse roller. The cost of mine has not been found,

for want of a standard of comparison; but I presume it is about the same as that of Aveling's.

My roller is seven feet high and six feet long. It is in three parts to make it turn easily. The middle part is fixed and the outer parts are loose on the axle. An arm on the middle part carries a bevel pinion, which goes into bevel wheels that are fixed to the outer posts, and forces them to turn, but allows them to turn at different speeds when on curves. Four-fifths of the whole weight are on the roller, and driven, and effective for adhesion. A pair of steering wheels, fourteen feet from the roller, bear a fifth of the weight. Aveling's is arranged like his traction engine, so far as the machinery and driving apparatus are concerned. The driving wheels are five feet high and eighteen inches wide, and are efficient rollers. There is in front a roller in two parts, in a turn table, to steer by. When going straight forwaad both drivers are held to the axle, and about half the total weight is effective for adhesion; but when turning one driver is loosened, and only a quarter of the weight is effective. Thus he has but fifty, and at times but twenty-five, while I have at all times eighty per cent of the weight available for adhesion; and this is an important difference, for when going over fresh gravel or broken stone, on which the resistance to rolling is one eighth of the weight, there is some slipping, even in the most favorable case, and the slipping cracks the ground to a depth of several inches, and prevents a prompt consolidation of the materials. Mons. Gelerat, the inventor of some of the rollers used in Paris, applies power to both front and rear wheels, to prevent slipping, which he considers so injurious as to be avoided at much expense of construction.

Mr. Aveling uses a chain to transmit the power from the intermediate shaft to the driving axle. I use bevil gearing. The chain has been used on steam carriages thirty years ago, also within two years, and on road locomotives in France within a few years, and has been generally condemned, but Mr. Aveling, after much careful practice, seems to have made it strong. But in a recent English specification for a contractor's locomotive it is provided that chain gearing shall not be used—a presumptive evidence that it is not approved by a competent engineer who probably has seen it on Aveling's engines.

To save cost these machines have all single engines. I designed mine with a double engine, as nearly as possible on the locomotive principle; but I was overruled. I intended to make it a good road locomotive as well as a good roller; and to do this it was the more necessary to have a double engine, which can allow four tanks more than a single engine, and more than that if the steam be cut off at about half stroke. Had it been built as designed its power to draw a load, or work without slipping, would have been 1½ times greater than that of Aveling's when both its drivers are fastened. This is an advantage about which the English and French engineers have had ample opportunities to judge by observation, disagree—the French preferring double, the English single engines. I agree with the French, and I believe the English will come to that practice when they get to work efficiently with rollers heavy enough to make durable roads.

All the rollers now in use are too light; they make little impression, and have to go many times over. In France, before steam rollers were used, loose rollers weighing 8¼ tons, worked by 12 horses, were drawn 100 times over roads; and in Belgium a 30 ton roller, six feet high and very narrow, was found to make a better road than a lighter roller. It is necessary, in order to make a road strong, so that its stones may not be rubbed against each other, that cement instead of sand should be used as binding material; but this cannot be done advantageously unless the rolling can be completed before the cement begins to set, which it will do sooner than a loose roller, or even a light steam roller can complete itself, the rolling be continued during the setting the cement is broken, and does not reset and become strong; and it is not safe to assume that we can allow many hours for the work, for some cement sets firmly in twelve hours.

Macniel, when assistant to Telford, collected data to show what strength roads required. He found that ten hundred weight was often carried on each width of a four feet wheel, and sometimes greater loads. Now, to make a road so strong that such loads will not indent it, the angles of its stones must be crushed, and the cement squeezed into its place while it is soft; and to do this the roller must press with more than half a ton on each of the width, if it be four feet diameter; and for a greater diameter the weight must be increased in proportion to the square root of the diameter, to give equal compression.

Small rollers push up the metal before them, if they be heavy, and the more so if they slip. The weight may be increased as the diameter, without pushing up the material, or raising a wave, and the depth of penetration or compression will be as the square root of the diameter of the roller; so that if a four feet roller will penetrate half an inch a nine feet roller will penetrate three-fourths of an inch at one transit. It is therefore expedient to use very large rollers—as large as can be got over bridges and through streets that have pipes and sewers under them. To press with the force often exerted by wagon wheels, and to do it without going many times over, and increasing the load as the consolidation advances, and incurring danger that the cement will begin to set, a roller ten feet high and 100 tons weight should be used. Such a roller would weigh forty tons empty.

No gearing known can propel such a roller on fresh gravel or metal, which resists rolling with a force of an eighth to a sixth of the weight. I have therefore designed a roller to be worked by hydraulic engines, acting directly on cranks of the axle of the roller. A steam pump is to circulate oil through the cylinders, and there is to be in the exhaust pipe an automatic regulating valve, which will prevent the roller from running down hillocks with a jolt, which gearing does not prevent.

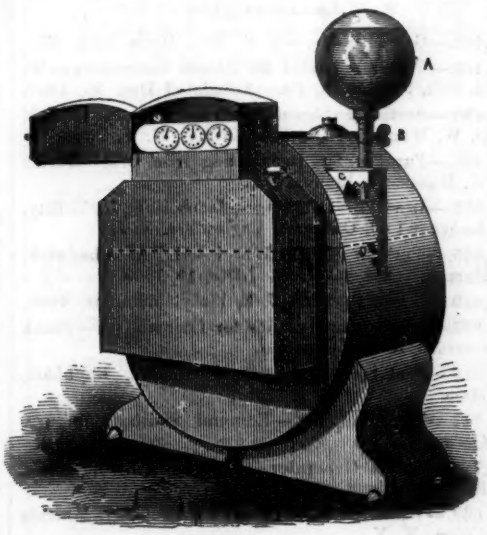
Single engined rollers cannot work at less than two miles an hour steadily, on uneven roads. Double engined rollers can work at lower speed, but with loose gearing, and an elastic medium-like steam. No engine can work with the slowness and steadiness required to give time for settling and crushing, but hydraulic engines can work as slowly as desired, and lower down hillocks, and get out of holes, without sensiby stopping their speed.

After a few remarks by Mr. Oastler, in which he explained the manner in which chain-gearing has been made durable and satisfactory in the English road rollers, the meeting adjourned.

Trumbore's Improved Gas Meter.

Much time and labor have been expended by inventors, in the endeavor to produce an instrument that will measure gas automatically and correctly. It is quite essential to the gas company, or whoever manufactures the gas and supply it to the consumer, to have a reliable instrument that will correctly measure and record the amount of gas distributed to each consumer; and it is also important to the consumer to know that the meter attached to his service pipe is as reliable as the chronometer watch he carries in his pocket.

There are two kinds of gas meters in general use—the wet meter, so named because it acts upon the principle of displacing a given volume of water with an equal volume of gas in an inverted vessel or measure. A series of inverted measures are arranged to revolve about an axis through the buoyancy of the gas. This axis is supplied with wheel gearing which moves the recording index, showing the amount of gas that passes through the meter.



The dry meter acts upon the principle of a bellows. A series of flexible chambers are successively filled and emptied of gas automatically through its pressure, at the same time moving the recording mechanism. This apparatus involves the use of valves having more or less friction, and the leather diaphragms are liable to become pervious to gas and less flexible after long usage, or by changing temperature, which affects the accuracy of the meter.

It is generally conceded that the "wet meter" is the most simple and reliable, provided the water or other fluid in which the measuring wheel revolves can be kept at a uniform height. The gas tends to absorb it, and in time it requires to be renewed, or the meter will not measure correctly, and finally will stop entirely. In filling it as usual, by hand, it is liable to be filled too much, which also affects the working of the meter.

The accompanying engraving exhibits a simple but efficient improvement, which obviates the difficulty above mentioned, and serves both to make the wet meter accurate and reliable, and saves the trouble of often "filling the meter," as it is commonly expressed.

It consists in attaching, by soldering to the side of the meter case, a tight box or chamber shown at C, with its side broken away, to show the different parts.

At D are two small holes piercing the case, one just above the other, t upper hole being on a line with the required height of the water in the meter. A glass vessel, or fountain, A, provided with a tube and stop cock, B, is filled, inverted, and screwed into the top of chamber, C.

When the stop cock, B, is opened the fluid descends into chamber, C, and through orifice, D, into the meter, until the orifice, D, is closed, when the flow ceases, because the gas which must pass into the chamber, C, and up into the reservoir, A, to supply the vacuum, is cut off. Of course this action will be repeated every time the water line falls below orifice, D; consequently the meter is kept constantly in correct working condition—the glass reservoir showing when it requires to be replenished.

Letters patent for this useful and valuable invention have been applied for by us for the inventor, Samuel Trumbore, Easton, Pa., of whom further information may be obtained.

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—Eds.]

An Honest Man.

We take the liberty to publish the following letter, because the writer exhibits two good qualities in a few words, viz., honesty and appreciativeness.—Eds.

OFFICE SCHENECTADY GAS WORKS,
January 8, 1870.

Messrs. Editors: I received your bill dated October, 21, 1869, for $3 for the AMERICAN GAS LIGHT JOURNAL which was not large enough for the time that I have received the Journal. Please send me a bill for the amount from the time you sent the first paper (to 12th July, 1870) and I will send you my check for the amount, as I appreciate your Journal as a paper indispensable to a person engaged in the business of manufacturing gas. Yours respectfully,

ROBERT CLEMENTS, Sup't.

Complimentary.

[As many of our readers may not know that we do Job Printing and Book Binding, we insert the following letter, which tells its own story.—Eds.]

OFFICE OF ABBOTSFORD GAS LIGHT CO.
HASTING UPON HUDSON, January 12th 1870.

Messrs. Editors: Enclosed please find $1.75 in payment of bill for binding Journal. I am greatly obliged to you for the particular attention you have given to furnish me with a good substantial binding.

Respectfully yours,
J. H. Brown.

Answer to Inquirer about Exhausters.

Messrs. Editors: Your correspondent's question relative to Exhausters is, I think, an important one, inasmuch as it may clear away some of the misapprehensions of their use and requirements. Permit me, in answer to his query, to observe that in any case that you work the Exhauster, even one-tenth below zero, most certainly you will get either air or sulphur compounds into the gas. To work with one and a half inch vacuum is worse than madness; and as far as the public are concerned direct robbery, as instead of gas, you give them one-third air; and as one per cent. of air will destroy illuminating power ten per cent., it is not surprising that with such injudicious use of the Exhauster, to be continually hearing the cry of poor gas. The notion is somewhat prevalent that it is absolutely necessary to use an Exhauster with Clay Retorts. My own experience of fifteen years convinces me such is not the case; and I have no hesitation in

saying, that with gasholders giving under four-inch pressure, your gas is more uniform in illumination—the yield is as good. The retort itself is stronger than with an exhauster. Another source of evil—the men who drive the exhauster may, and do injure the companies credit this way—the day man and night man try who can make the greatest show on the meter, and they very soon learn how to accomplish this, by driving the engine faster, or as an engineer at a works in Connecticut naively informed me, "putting the regulator on," which being interpreted was this—taking a three quarter plug out of inlet pipe and drawing in air; the consequence of such recklessness I need not explain further than it is a fact, that in the city I allude to, the gas one day is fourteen candles, another eight or nine.

I would suggest to superintendents, as a check to this fraud (as it is they who suffer in public estimation), that they have fitted up in the exhauster room a simple jet photometer, and let the same be kept continually burning; this I feel sure would correct this evil and lessen the cry of poor gas, and I am quite sure no gas company desires to increase its receipts by such dishonest practices. Yours respectfully,

JOHN KEELING.

Improved Patent Oxide of Iron.

NEW YORK GAS WORKS, 21st St., AND AV'E A,
NEW YORK, January 12th, 1870.

Messrs. Editors: We, the undersigned, desire to present to the various Gas Companies throughout the United States, for the purification of gas made from bituminous coals; our *newly prepared Oxide of Iron Composition;* which for efficiency, durability of action, and economy, has no equal in the list of purifying agents in this country or in Europe. It has been used at the New York Gas Works in the city of New York for two years past, and is now working with efficiency; as well as in several towns in Massachusetts. We will guarantee to any company disposed to give it a fair trial the best results. It has purified over 100,000 cubic feet of gas per bushel, and by very slight additions can be made to last almost an indefinite period of time. It will upon a single test, without being removed from the purifier for reoxidation, purify per bushel from 6,000 to 7,000 cubic feet of gas made from Westmoreland coal. It is then taken out and exposed to the action of the atmosphere for thirty-six hours, when it is ready to be used again, and so on; the usual test paper (as in the case of Lime purification), being used to test the purity of the gas. It will be prepared at cost price upon the ground of any company purchasing the right if desirable, or furnished upon order. Its first cost is about seventy cents per bushel, and it can be worked in any purifier in which Lime has been worked, by substituting in place of the trays or sieves one layer of perforated boards, which is all the alteration in any case required. The quantity requisite is regulated by the number of superficial feet there may be in the purifier. One bushel per foot gives enough margin for all practical purposes. We will make arrangements with any company to superintend the preparation of the material, or to furnish it ourselves; see that it is properly placed in the purifiers; and give sixty days trial; when, if found satisfactory, the right of use can be purchased upon the following schedule of rates or prices, upon the daily manufacture averaged for the full term of the patent granted.

From	7,000	cubic	feet to	25,000	$200
"	25,000	"	"	50,000	400
"	50,000	"	"	100,000	500
"	100,000	"	"	150,000	750
"	150,000	"	"	200,000	1000
"	200,000	"	"	250,000	1250
"	250,000	"	"	300,000	1500
"	300,000	"	"	350,000	1750
"	350,000	"	"	400,000	2000
"	400,000	"	"	450,000	2260
"	450,000	"	"	500,000	2500

and so on in the same proportion.

The right of use is granted until the 7th day of April, 1885. Any information required may be had by applying to

WM. H. ST JOHN, PETER CARTWRIGHT. } Patentees.

[On the subject of the above communication, an Editorial note will appear in our next, having been crowded out this time.—H. W.]

The New Gas Works at Englewood, N. J.

[Mr. T. T. Tasker, the enterprising and gentlemanly superintendent of Englewood Gas Works, has kindly furnished the following data and remarks about the new works lately erected at that thriving suburban town. It goes to show the fact that small gas works are being much more generally introduced, and we know from our observation they are, when well managed, reasonably profitable.—EDS.]

ENGLEWOOD, N. J., January 25, 1870.

Messrs. Editors: As per your desire, I send statement of the works here, as well as my humble ability permits. The works are six inches, with three benches of retorts, consisting of one bench of three, one of two, and one single one; the last two benches have arches sufficiently large for three retorts, and when the consumption calls for it, can be easily altered to threes, the inlets of the hydraulic mains being already there, and the dip pipes secured: the retorts are of iron, nine feet long, one retort now working and making 2,500 feet per day, but have had it working up to 3,600 feet per day for about four weeks; the washer is nine feet by one foot, and a jet of water plays inside from a spring close by the works. Ten condenser pipes with closed box at bottom and overflow leading direct to the tar well outside; there are four purifiers (dry lime), 4 by 6 long, 3 by 6 wide, 2 by 8 deep; station meters four feet diameter; gasholder 34 by 11 feet, and can contain 10,000 feet, with four guide pulleys working on posts resting on the side of tank, and four more below the water line working on flat plates built in the brick work of the tank; 1300 feet 6-inch mains, 3200 feet 4-inch pulleys, 8900 feet 3-inch pulleys. We have 35 consumers but no street lamps. The consumers' meters (all dry) showed a consumption of 65,000 feet for the three weeks ending January 1st, against 78,000 feet by station meter. The works are new and started about the 1st of December last. We have found a number of leaks in the mains during the past three weeks, and have reduced the leakage very considerable. The gasholder is covered with a rather stylish building, with a Mansard roof, as is the roof of the retort house and other portions of the buildings.

It would be a difficult matter for a stranger to find the gas works here from external evidence. The works were built by Morris, Tasker & Co., of Philadelphia, under the superintendence of Mr. P. Munzinger, Gas Engineer of the above firm.

Judging from the number of consumers, it would not appear a very desirable gas stock, but the directors are very sanguine of more than double the consumers before the year is past.

I suppose you have never received a report of a public gas works whose consumers were so numerically small as this; and some of the directors were half ashamed to make it known, but I reasoned differently, and think it redounds to their credit and enterprise to start a works with so little prospect of its paying; nevertheless, they have great expectations, and calculate to more than double the consumption by next winter.

Respectfully yours,
THOMAS T. TASKER.

Recent American Patents.

Pertaining to Gas, Water, Etc., for the Week ending January 29, 1870.

98,462.—Gas Machine.—S. R. Ball, Hyde Park, Ill.

98,469.—Water Indicator for Steam Generators.—W. G. Bell, Pittsburgh, Pa. Antedated Dec. 30, 1869.

98,490.—Sectional Steam Generator.—John Griffith, G. W. Wundram, and T. M. Muller, N. Y. City.

98,496.—Furnace for Deoxidizing Iron Ore.—Abram W. Honsinger, Rome, N. Y.

98,501.—Lead Pipe Coupling.—Jacob Hoyt, N. Y. City. Assignor to J. O. Morse, Englewood, N. J.

98,665.—Turbine Water-Wheel.—H. A. Chadwick, Burnet, Texas. Antedated Dec. 29, 1869.

98,680.—Vapor Burner.—J. E. Finly, Memphis, Tenn.

98,685.—Water Supply Pipe for Locomotives.—Frank Gerrard, Kansas City, Mo.

98,686.—Water Meter.—Othniel Gilmore, Raynham, Mass.

98,717.—Pipe Coupling.—Edmund Smith, Hamburg, Germany.

98,726.—Steam Generator.—Francis William Webb, Bolton, England.

98,639.—Water Wheel.—Edward M. Buckley, Amenia Union, N. Y.

98,774.—Gas Burner.—Joseph W. Cremin, N. Y. City.

98,767.—Gas Heater.—D. G. Haskins, Cambridge, Mass.

98,776.—Gas Regulator.—Peter Keller, N. Y. City.

98,802.—Steam Generator.—J. B. Root, N. Y. City. Antedated Nov. 24, 1869.

98,805.—Steam Boiler Furnace.—J. Q. C. Searle, Topeka, Kansas.

98,810.—Steam Pump.—Thomas Snowden, G. T. Snowden, and I. V. Lynn, Pittsburgh, Pa.

88,817.—Vapor Burner.—W. W. Tyson, Alleghany City, Assignor to Philip Weisenberger, Pittsburgh, Pa,

98,824.—Vapor Burner.—Henry Wellington, (assignor to himself and T. P. Doane), Chicago, Ill.

98,828.—Water Wheel.—William M. Wheeler, Berlin, Mass.

98,842.—Vapor Burner.—William Bliesner, St. Louis, Mo.

98,865.—Non-conducting Covering for Boilers, Steam Pipes, etc.—Washington Harris, Philadelphia, Pa.

99,883.—Mode of Producing Light by the Combination of Solid and Liquid Hydrocarbons.—Joseph Phillips, Cologne, Germany.

98,881.—Current Water Wheel.—Artaxerexes W. Sory, Prarie County, Arkansas.

98,913.—Turbine Water Wheel.—Hugh Boyle, Waterloo, Iowa.

98,952.—Water Elevator.—Mathew D. Gray, Terre Haute, Ind.

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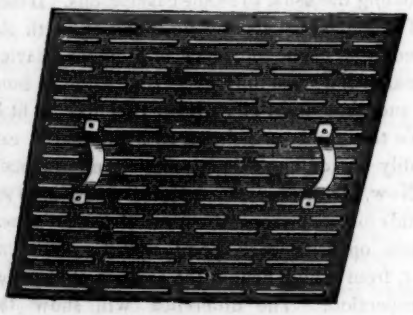

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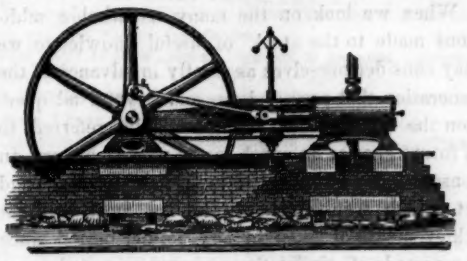

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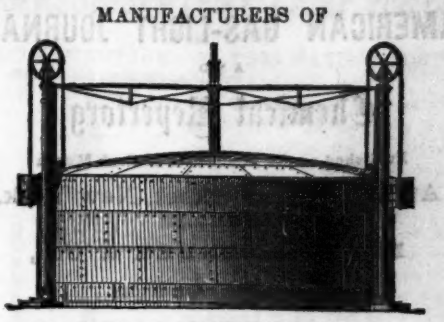

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[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

WEDNESDAY, FEBRUARY 2, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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A PROGRESSIVE AGE.

When we look on the many remarkable additions made to the stock of useful knowledge we may consider ourselves as greatly in advance of the generation that preceded us, and beyond all question the age in which we live will be referred to in future ages as an epoch in the world's history, in consequence of discoveries in the field of science and art which transcend entirely the most brilliant achievements of man in any former period since the records of civilization were commenced.

It would be a labor of immense research to trace from small beginnings, the gradual unfolding of those germs of thought, which in their perfect development have changed the moral and intellectual aspect of the world. The philosopher, whose names are associated with all that is great and marvelous in antiquity, melt into insignificance when their interpretations of nature are compared with the demonstrations in the present century of whatever is grand and true in the march of useful knowledge. Even the sun, that life-difusing centre of the solar system, whose distance in the realms of celestial space defies the scrutiny of unassisted eyes, has, through the perfection of optical imstruments, within less than ten years been subjected to the close scrutiny of the curious, so that they may not only determine with considerable accuracy its physical structure, but may analyze the rays of light which emanate from its dazzling envelope. With the spectroscope at command, persons making no pretenions to the lofty attainments of astronomers. speak in familiar conversation of the composition of distant planets—of the metels they contain, their hydrogen, and even refer to revelations taking place millions upon millions of miles distant beyond the orbit of the moon, as though they were as conversant with every-day events taking place in the heavens. Incredible as it may appear to those who have failed to keep pace with the rapid advances in science, there is no limit to the boundless ambition of man to comprehend the mysteries of his being and to solve problems of his surroundings. With animal instincts and an organization that proves his relationship to inferior races, he exhibits powers and sentiments which are immortal.

Among some of the marked achievements of science of such import as to stamp this particular period with historical eminence, is steam and its adaptations Within the distinct recollection of men now living steam has been utilized and made servicable in a thousand ways for carrying on the business purposes of life. Steam was no new thing five thousand years ago, but it required more than forty centuries for the birth of a person who had the right kind of brains to perceive how it might be converted into a motor force. It is not a hundred years since boats and all conceivable machinery were first propelled by steam, and now it is doing in different countries what would require half the male inhabitants and all the horses and oxen in existence to do—to move the ships, run the mills, foundries, and tens of thousands of mechanical contrivances in active operation. We will not discuss the merits of steam. Not to admit its inestimable value, directed and controlled by modern ingenuity, would be an insult to the common sense of mankind.

Electricity, which has but just commenced a career which promises another and even mightier revolution than steam, is running on wires from one continent to another, over broad rivers, creeping across the profound abyses of oceans and seas, conveying messages, almost as rapidly as thought, and communicating in all languages intelligence in regard to the transactions of cities and villages on opposite sides of the globe. Electricity is an unmistakable power. Nature used it as an obedient servant from the dawn of creation in those terrific displays which rent the everlasting rocks, and swept gigantic oaks, with their gnarled branches, to destruction. Where the application of electricity is to end requires a prophetic vision to decide. It turns lathes, run sewing machines, etc., and bids fair to be made serviceable as a motor in this prolific age of philosohpical wonders.

Of the rapid development in mechanism it is a hopeless enterprise to recount. Almost everything is fashioned by machinery. It would be quite an undertaking to particularize what is not made by machinery and what is. There is scarcely a limit in the United States to processes of manufacturing which are not fully and perfectly accomplished by its indispensable aid. With machines we grind, saw, plane, drill, roll, crush, spin, weave, bake, brew, carve, turn, mow, plow, reap, thrash, load teams, unload ships, pump mines, etc., etc.

Great progress has also been made in Chemistry a science that has conferred, and is continually conferring, blessings upon the age. To recount simply the discoveries which have given distinction to the names of DAVY, LEIBIG, and FARADAY, who have unsealed volumes in the book of nature, of inestimable importance to the arts, would be only a repetition of the obligations our civilization is under to the indomitable energies of those extraordinary men. Others, and many too, in the same experimental research have achieved a prominent niche in the temple of Fame.

The discoveries in dyeing—finding material for beautiful tints in *coal tar* and other refuse substances where no such products were ever suspected to reside; the discoveries and application of various gases in domestic economy, and indeed all sorts of methods of producing food from materials of small value, impress the thoughtful with the wonder-workings of chemical science. We could enter more fully into other and later improvements of the age, but space will not permit.

Such, however, is science to-day, at the opening of 1870. The world still moves! Man still reasons and acts. What there is in the future who can dare to phrophecy. Progress is inscribed on the frontlet of humanity.

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GAS-LIGHT JOURNAL.—We welcome the number for January 3d, which is, for some unaccountable reason, the first we have seen of this valuable Journal for many weeks. We regret the loss of Prof. Wurtz's *Chemical Repertory* for so long a time. We always find something good in it.

The above is from the *Scientific Press* of San Francisco—the best, and we may say, the only real Scientific Journal on the Pacific Coast. Why our Journal fails to reach the *Press* is a mystery—unless it is owing to the Post Office department. It is regularly mailed. If not duly received in future, please inform us, and we will overhaul Uncle Sam's carriers.—EDS. GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY.

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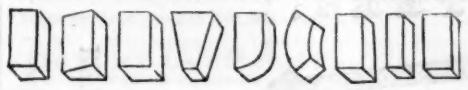

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1st. The saving of the base or bottom part of the Post, when the column is broken, the Post being made in two parts. The broken column can be replaced by a new one, without disturbing the base.

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3rd. When a stoppage of gas in stand pipe occurs, the column can be lifted out, the pipe detached, cleaned, and replaced in fifteen minutes; no digging being required as is now done with the old Post.

4th. A lighter and better casting can be made from this patent, and it can be handled better, owing to its length and lightness.

5th. In case a broken column cannot be repaired, one third of the original cost is saved by the base being secured and perfect.

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Certificate.

ST. LOUIS, September 1, 1869.

I have examined a new Lamp Post, the Branson patent, and unhesitatingly pronounce it to be the best thing of the kind I have ever seen. Posts of this description have been erected in this city, and in my opinion this style of Post should be universally adopted, as I believe it possesses all the advantages claimed for it.

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[Extract from testimony from Suprintendent Chelsea Gas Co., Mass.]

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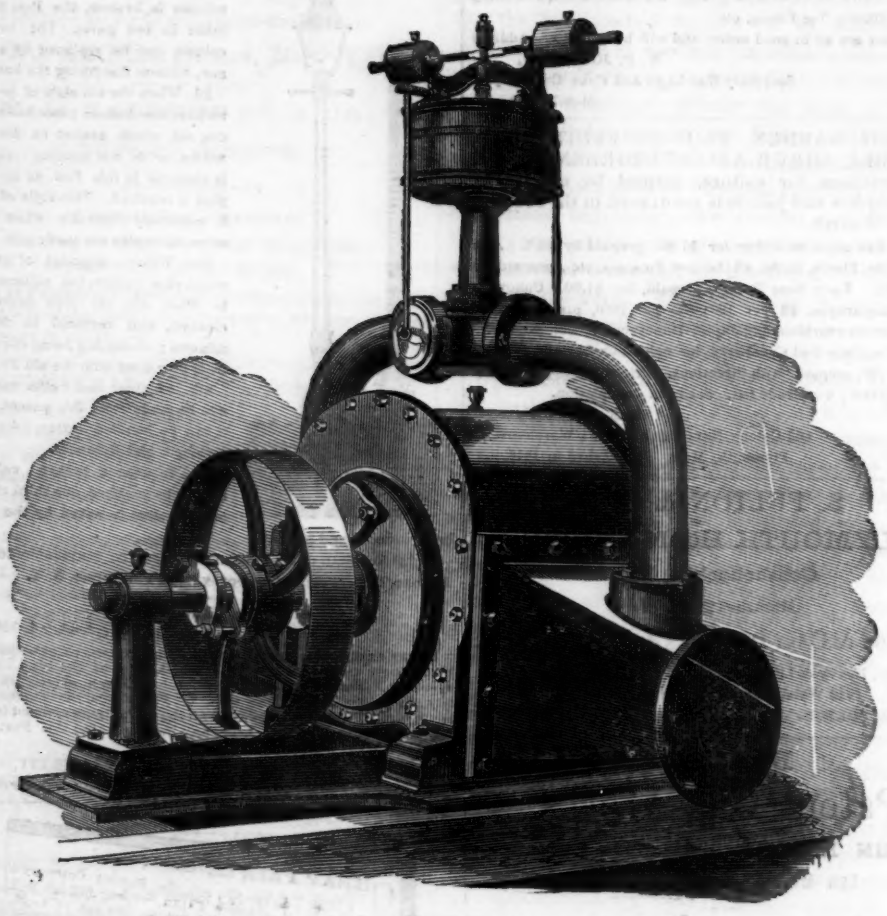

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

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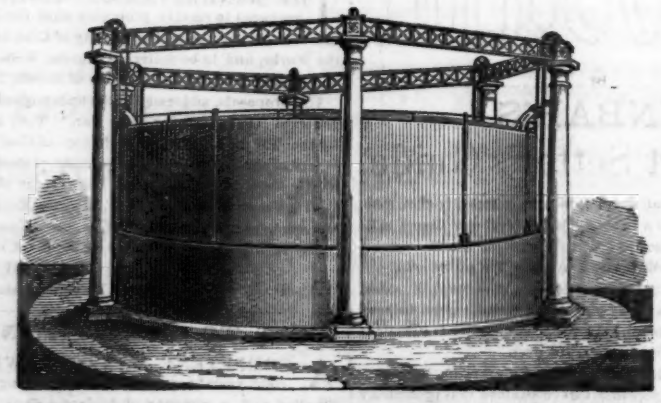

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FIG. 1.

Fig. 1 shows a single gate valve.

Fig. 2 represents wedge and one-half of gate of double valve, intended for larger sizes, when required to bear heavy pressure either side.

Fig. 3, represents a section through body, gate and wedge.

The slides, G G, are held against wedge D, by ribs, H H, projecting from sides of valve body, A.

In closing the valves, when opening I is covered, slides, G G, pass the lower ends of ribs, H H, when the wedge, D, can move forward on the inclined planes E E, and crowd the gates apart.

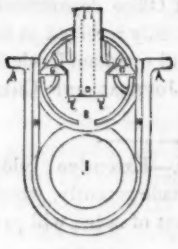

FIG. 3. FIG. 2.

[From A. F. Havens, Engineer Brooklyn Gas-Light Co.]

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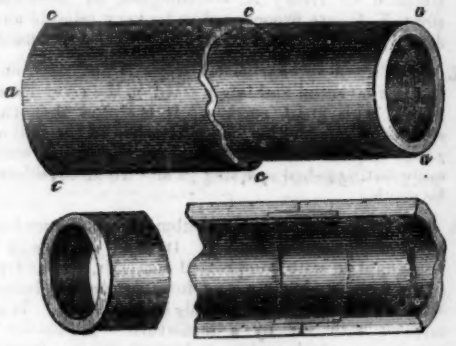

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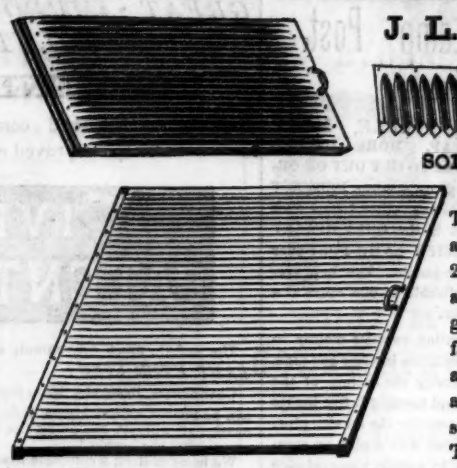

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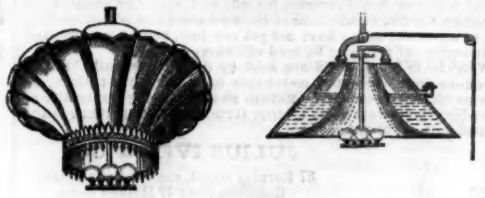

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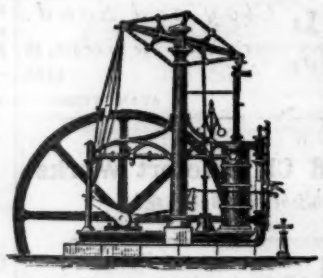

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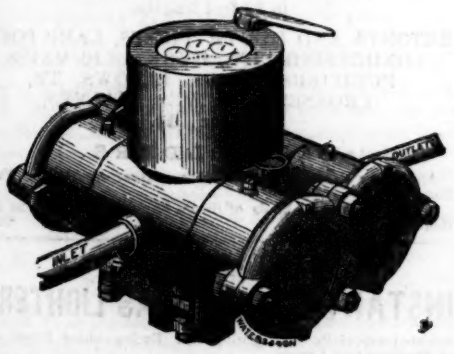

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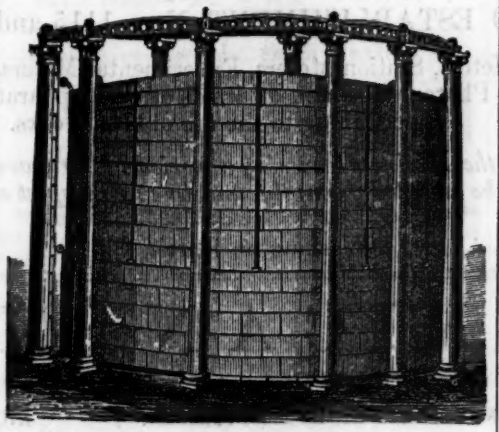

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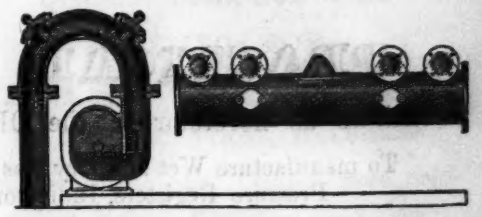

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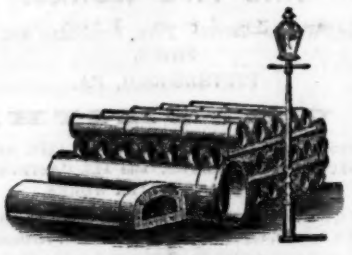

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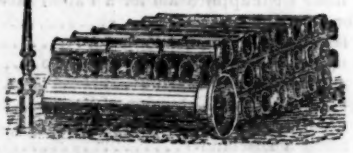

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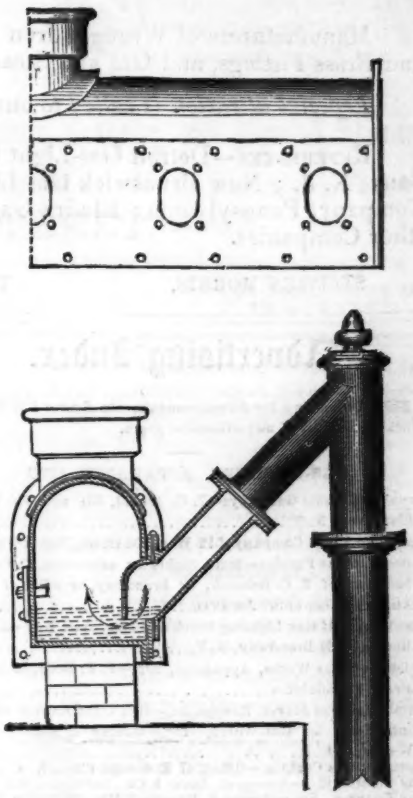

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